

REMARKS/ARGUMENTS

Reconsideration of the application in view of the above amendments and the following remarks is respectfully requested.

Status of the Claims

Claims 11-15 and 17-23 are pending. Claims 1-10 were previously withdrawn from further consideration, as being drawn to a provisionally non-elected invention. Claim 16 was cancelled by prior amendment without prejudice or disclaimer to the subject matter recited therein. Claim 11 has been herein amended. No new matter is added

Support for the amendment to claim 11 can be found in the specification at, for example, page 13, lines 5-12 and page 14, line 19 bridging page 15, line 7.

Rejections under 35 U.S.C. §112

Claims 11-15 and 17-23 stand rejected under 35 U.S.C. §112, second paragraph, as being indefinite to particularly point out and distinctly claim the subject matter regarded as the invention. Specifically, the Office Action contends that the phrase “sequentially along the growth direction” renders independent claim 11 ambiguous. Detailed Action, pages 2-3, item 2. Dependent claims 12-15 and 17-23 stand rejected based on their dependency from claim 11.

Applicants respectfully disagree. However, solely in order to expedite prosecution, and without conceding the correctness of the Examiner’s rejection, Applicants have amended claim 11 by removing the phrase “sequentially along the growth direction.” It is respectfully submitted that amended claim 11 is not ambiguous.

Reconsideration and withdrawal of the rejection of claims 11-15 and 17-23 under 35 U.S.C. § 112, second paragraph is respectfully requested.

Rejections under 35 U.S.C. §102

Claims 11, 17 18 and 20-22 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Published Application No. 2003/00155724 of Nakamura et al. (“Nakamura”).

Nakamura describes a Ga-rich and In-poor quantum well layer in paragraph [0075]. In this paragraph, Nakamura indicates that the quantum well layer is horizontally composed of In-rich regions 54a and In-poor regions 54b (*see* Fig. 6). The separation of In-rich regions 54a and In-poor regions 54b is caused by the lattice mismatch with the underlying layer. In its examples, Nakamura merely discloses an In-poor $In_{0.02}Ga_{0.98}N$ quantum well layer. Further, as stated in paragraph [0032]:

the decomposition temperatures of InN and GaN, which constitute InGaN, largely differ from each other, and thus InGaN tends to be subjected to phase-separation into InN and GaN. **Therefore, an increase in indium content makes it difficult to obtain an active layer having a uniform composition. For these reasons, the content of indium in an InGaN semiconductor that forms an active layer tends to be suppressed to a low level in a conventional semiconductor device.**

(Emphasis added.) Applicants respectfully submit that there is a distinction between an “In-rich InGaN quantum well layer” and an “In-rich region in the quantum well layer.” An $In_{0.02}Ga_{0.98}N$ quantum well layer may be described overall as a “Ga-rich InGaN quantum well layer” or “an In-poor quantum well layer”; however, the same $In_{0.02}Ga_{0.98}N$ quantum well layer may have in it both an In-rich region and an In-poor or Ga-rich region.

Applicants submit that Nakamura discloses an active layer consisting of IN-rich regions 54a and an In-poor regions 54b. *See* Nakamura, ¶0075-76; Fig. 6. Nakamura discloses an In GaN quantum well layer in which the In-rich regions 54a and In-poor regions 54b are formed **horizontally** — specifically “Each indium-rich region 54a and each indium-poor region 54b are alternately arranged substantially regularly in the plane direction of the well layer.” Nakamura, ¶0076 (emphasis added). Further, Nakamura merely discloses an $In_{0.2}Ga_{0.8}N$ quantum well layer with In-rich regions 54a. Nakamura, ¶¶0090, 0112 and 0120. Nakamura discloses that In-rich regions 54a correspond to $In_{0.4}Ga_{0.6}N$ and In-poor regions almost correspond to $In_{0.02}Ga_{0.98}N$. Nakamura, ¶0122.

Independent claim 11 has been amended to now recite “an additional nitride semiconductor layer grown on the In-rich InGaN quantum well layer and having a band gap energy higher than that of the In-rich InGaN quantum well layer; wherein the In-rich InGaN quantum well layer comprises an In-rich region, a first compositional grading region with In content increasing between the top layer of $Al_xGa_yIn_{1-x-y}N$ ($0 \leq x \leq 1$, $0 < y \leq 1$, $0 < x+y \leq 1$) and the In-rich region, and a second compositional grading region with In content decreasing between the In-rich region and the additional nitride semiconductor layer.” It is respectfully submitted that Nakamura fails to disclose, or suggest that the single quantum well layer is made of In-rich InGaN, as recited in independent claim 11. Thus, Nakamura fails to disclose each and every feature of claim 11. Therefore, Nakamura fails to anticipate claim 11, and its dependent claims.

Reconsideration and withdrawal of the rejection of claims 11, 17 18 and 20-22 under 35 U.S.C. § 102(b) based on Nakamura is respectfully requested.

Rejections under 35 U.S.C. §103

Claims 12, 14, 15, 19 and 23 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Nakamura in view of U.S. Published Application No. 2004/0195598 to Tysoe. Claim 13 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Nakamura in view of U.S. Published Application No. 2003/0209704 to Yamada.

Claims 12-15, 19 and 23 depend from claim 11, and recite the features of claim 11 as if set forth therein. Applicants submit that claims 12-15, 19 and 23 are patentable for at least the same reasons as discussed above for their base claim. Neither Tysoe nor Yamada disclose those features of claims 12-15, 19 and 23 demonstrated to be missing from Nakamura.

Tysoe discloses composition $\text{In}_x\text{Ga}_{1-x}\text{N}$, where $0 \leq x \leq 1$. However, Tysoe fails to disclose, or suggest, an In-rich InGaN quantum well layer wherein Ga in this layer is mainly supplied from the underlying layer, as demonstrated above to be set forth in independent claim 11. Therefore, Tysoe does not cure the deficiencies of Nakamura discussed above.

Further, a person of ordinary skill in the art at the time of the invention would not know what structure would result from the combination of Nakamura ($\text{In}_{0.2}\text{Ga}_{0.8}\text{N}$ quantum well layer with In-rich regions 54a and In-poor regions 54b) with Tysoe (In-rich $\text{In}_x\text{Ga}_{1-x}\text{N}$ quantum well layer). Therefore, a combination of Nakamura and Tysoe, to the extent proper, does not render claims 12, 14, 15, 19 and 23 obvious.

Yamada relates to a multi-quantum well structure with a first well layer and a second well layer having a different wavelength with the first well layer in which the degree $R (= S/L [S: total length of dished portions D, L; total length of active layer'])$ has a certain value (for example, not

less than 0.1) to provide a smooth or flat interface with a barrier layer for high crystallinity. Yamada ¶¶0030, 0038. Further, a combination of Nakamura (quantum well layer with In-rich regions 54a and In-poor regions 54b) with Yamada (flattening the dished portion D), does not result in the invention of claim 13. Therefore, a combination of Nakamura and Tysoe, to the extent proper, does not render claim 13 obvious.

Reconsideration and withdrawal of the respective rejection of claims 12, 14, 15, 19 and 23 under 35 U.S.C. § 103(a) based on respective combinations of Nakamura, Yamada, and Tysoe is respectfully requested.

CONCLUSION

Each and every point raised in the Office Action mailed March 2, 2009, has been addressed on the basis of the above remarks. In view of the foregoing it is believed that pending claims 11-15 and 17-23 are in condition for allowance and it is respectfully requested that the application be reconsidered and that all pending claims be allowed and the case passed to issue.

If there are any other issues remaining which the Examiner believes could be resolved through a Supplemental Response or an Examiner's Amendment, the Examiner is respectfully requested to contact the undersigned at the telephone number indicated below. view of the above amendment, applicant believes the pending application is in condition for allowance.

The Commissioner is hereby authorized to charge any unpaid fees deemed required in connection with this submission, or to credit any overpayment, to Deposit Account No. 04-0100.

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Respectfully Submitted,

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